| Table 11.1. Descriptive List of Targeted Benefits, Sub-Region 11, Eastern San Joaquin Valley above Tuolumne River | | | | | |
|---|---|---|---|---|---|
| **TB # (1) [duplicate]** | **Location (2)** | **Category of Targeted Benefit (3)** | **Bene-ficiary (4)** | **General Time-Frame (5)** | **Conceptual Completeness (6)** |
| 112 [131, 148, 171] | San Joaquin River | Flow: Provide flow to improve aquatic ecosystem conditions | Eco | Fall | Incomplete |
| 113 | Stanislaus River | Flow: Provide flow to improve aquatic ecosystem conditions | Eco | Year round | Incomplete |
| 114 [132] | Tuolumne River | Flow: Provide flow to improve aquatic ecosystem conditions | Eco | Fall - spring | Incomplete |
| 115 [93, 134, 150, 172] | San Joaquin River | Quality: Reduce group A pesticides to enhance and maintain beneficial uses of water | Eco or M&I | TBD | Complete |
| 116 | Stanislaus River | Quality: Reduce group A pesticides to enhance and maintain beneficial | Eco or M&I | TBD | Complete |
| 117 [135] | Tuolomne River | Quality: Reduce group A pesticides to enhance and maintain beneficial | Eco or M&I | TBD | Complete |
| 118 | Harding | TB Moved to Subregion 12 | | | |
| 119 | Harding | TB Moved to Subregion 12 | | | |
| 120 [82, 101, 137, 152, 173] | San Joaquin River | Quality: Reduce pesticides to enhance and maintain beneficial uses of water | Eco or M&I | TBD | Complete |
| 121 | Stanislaus River | Quality: Reduce pesticides to enhance and maintain beneficial uses of water | Eco or M&I | TBD | Complete |
| 122 [138] | Tuolomne River | Quality: Reduce pesticides to enhance and maintain beneficial uses of water | Eco or M&I | TBD | Complete |
| 123 [104, 140, 154, 174] | San Joaquin River at Vernalis | Quality: Reduce salinity to enhance and maintain beneficial uses of water | Eco, Ag or M&I | TBD | Complete |
| 124 [143, 157, 175] | San Joaquin River | Quality: Reduce temperatures to enhance and maintain aquatic species populations | Eco | TBD | Incomplete |
| 125 | Stanislaus River | Quality: Reduce temperatures to enhance and maintain aquatic species populations | Eco | Year round | Incomplete |
| 126 [143] | Tuolomne River | Quality: Reduce temperatures to enhance and maintain aquatic species populations | Eco | Year round | Incomplete |
| 127 | All affected lands | Quantity: Decrease nonproductive ET to increase water supply for beneficial uses | Eco, Ag or M&I | Year round | Complete |
| 128 | All suitable lands | Quantity: Provide long-term diversion flexibility to increase the water supply for beneficial uses | Eco, Ag or M&I | TBD | Incomplete |
| 129 [110, 146, 160] | Wetlands | Quantity: Provide long-term diversion flexibility to increase the water supply for beneficial uses | Eco | Variable | Incomplete |

| Table 11.2. Quantified Targeted Benefits, Sub-Region 11, Eastern San Joaquin Valley above Tuolumne River | |
|---|---|
| **TB # (1) [duplicate]** | **Source and Description of Quantified Targeted Benefit (7)** |
| 112 [131, 148, 171] | ERPP: Manage flow releases from tributary streams to provide adequate upstream and downstream passage of fall-run and late-fall-run chinook salmon, resident rainbow trout, and steelhead and spawning and rearing habitat for American shad, splittail, and sturgeon |
| 113 | ERPP: Maintain specified flow regimes: for example, provide the base flows in the Stanislaus River below Goodwin Dam in critical, dry, and below-normal years, minimum flows should be 200 to 300 cfs, except for a flow event of 1,500 cfs for 30 days in April and May. |
| 114 [132] | ERPP: Maintain specified flow releases: for example, in critical and below years 50 cfs Jun-Sept, 100 cfs Oct 1-15, 150 cfs from Oct- May plus 11,091 AF pulse flow.<br>Core: Provide the following flows and water depths for all life stages of chinook/steelhead fish: 10 day flow of 1500 cfs in October, water depth of approximately 2 feet in spawning reach from Oct. through May. |
| 115 [93, 134, 150, 172] | 303(d): Reduce [Group A pesticide] and DDT to ____. |
| 116 | 303(d): Reduce _____ [Group A pesticide] to ____. |
| 117 [135] | 303(d): Reduce _____ [Group A pesticide] to ____. |
| 118 | TB Moved to Subregion 12 |
| 119 | TB Moved to Subregion 12 |
| 120 [82, 101, 137, 152, 173] | 303(d): Reduce chlorpyrifos and diazinon to ____. |
| 121 | 303(d): Reduce diazinon to <0.04 ug $L^{-1}$ |
| 122 [138] | 303(d): Reduce diazinon to _____. |
| 123 [104, 140, 154, 174] | Core: Reduce salinity levels at 0.7 dS/m April 1 - August 1, 1.0 dS/m September 1 - March 31 at 303d: Vernalis.<br>Reduce salinity to _____. |
| 124 [143, 157, 175] | ERPP: Manage reservoir releases and other factors to provide suitable water temperatures for key resources from the Merced River confluence to Vernalis |
| 125 | ERPP: Provide suitable water temperatures for salmon spawning area during the fall and winter and to the mouth of the river durning the spring as follows: Oct 15 to Feb 15 - 56F and Apr 1 to<br>Core: May 31 - 65F. |
| 126 [143] | ERPP: Provide suitable water temperatures for salmon spawning area during the fall and winter and to the mouth of the river durning the spring as follows: Oct 15 to Feb 15 - 56F and Apr 1 to<br>Core: May 31 - 65F. |
| 127 | Core: Reduce unwanted ET by 4,800 acre-feet per year. |
| 128 | Core: Enhance the effectiveness of potential conjunctive use programs by reducing flows to groundwater to _____ acre feet per year during periods of shortage; and increasing flows to groundwater to _____ acre feet per year during periods of excess. |
| 129 [110, 146, 160] | ERPP/ Cooperatively manage ____ acres of ag lands and restore ____ acres of seasonal,<br>Core: semipermanent, and permanent wetlands consistent with the CV Habitat Jt Venture and N. Am. Waterfowl Mgmt. Plan. |

| Table 11.3. Quantified Targeted Benefit Change, Sub-Region 11, Eastern San Joaquin Valley above Tuolumne River | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Reference Condition | | Quantified Targeted Benefit | | Quantified Targeted Benefit Change | | | |
| TB # (1) [duplicate] | Data Source (8) | Data Availability (9) | Data Source (8) | Data Availability (9) | Data Source (8) | Data Availability (9) | Range of Values (10) | Specific Time-Frame (11) |
| 112 [131, 148, 171] | CVGSM | Unproven-precise | ERPP | Not available | Not available | Non-existant | Not available | Varies |
| 113 | CVGSM | Unproven-precise | ERPP | Rough estimate | Calculated | Rough estimate | 15.4 - 238 TAF | Year round |
| 114 [132] | CVGSM | Unproven-precise | ERPP | Rough estimate | Calculated | Rough estimate | TBD | Varies |
| 115 [93, 134, 150, 172] | TBD | TBD | TBD | Proven - precise | Calculated | TBD | TBD | TBD |
| 116 | TBD | TBD | TBD | Proven - precise | Calculated | TBD | TBD | TBD |
| 117 [135] | TBD | TBD | TBD | Proven - precise | Calculated | TBD | TBD | TBD |
| 118 | TB Moved to Subregion 12 | | | | | | | |
| 119 | TB Moved to Subregion 12 | | | | | | | |
| 120 [82, 101, 137, 152, 173] | TBD | TBD | TBD | Proven - precise | Calculated | TBD | TBD | TBD |
| 121 | USGS Circ. 1159 | Proven - precise | US EPA | Proven - precise | Calculated | Proven - precise (limited) | 0-0.046 ug $L^{-1}$ | Jan-Feb |
| 122 [138] | TBD | TBD | TBD | Proven - precise | Calculated | TBD | TBD | TBD |
| 123 [104, 140, 154, 174] | RWQCB | Proven - precise | RWQCB | Proven - precise | Calculated | Proven - precise | 15.4 - 238 TAF | Year round |
| 124 [143, 157, 175] | TBD | TBD | ERPP | Not available | Not available | Not available | Not available | Not available |
| 125 | TBD | TBD | ERPP | Unproven - precise | Calculated | TBD | TBD | Year round |
| 126 [143] | TBD | TBD | ERPP | Unproven - precise | Calculated | TBD | TBD | Year round |
| 127 | CVGSM | Unproven-precise | Core | Rough estimate | Calculated | Rough estimate | 4.8 TAF | TBD |
| 128 | CVGSM | Unproven-precise | Core | Rough estimate | Calculated | Rough estimate | TBD | TBD |
| 129 [110, 146, 160] | CVHJVIP | Insufficient | CVHJVIP | Uproven - precise | Not available | Insufficient | Not available | Not available |

| Table 11.4. Quantifiable Objective, Sub-Region 11, Eastern San Joaquin Valley above Tuolumne River | | | | | |
|---|---|---|---|---|---|
| TB # (1) [duplicate] | Available Agricultural Potential (12) | Quantifiable Objective (13) | | | |
| | | Level 1 | Level 2 | Level 3 | Level 4 |
| 112 [131, 148, 171] | TBD | | | | |
| 113 | 73 - 268 TAF/Yr | 15.4 - 71.6 TAF @ 120 $/AF/Yr | 15.4 -125.6 TAF @ 126 $/AF/Yr | 15.4 -154.6 TAF @ 147 $/AF/Yr | 15.4 -190.7 TAF @ 157 $/AF/Yr |
| 114 [132] | TBD | | | | |
| 115 [93, 134, 150, 172] | | | | | |
| 116 | | | | | |
| 117 [135] | | | | | |
| 118 | TB Moved to Subregion 12 | | | | |
| 119 | TB Moved to Subregion 12 | | | | |
| 120 [82, 101, 137, 152, 173] | TBD | | | | |
| 121 | Eliminate Runoff from Rain (Jan-Feb) | Dependent on local cultural costs (cover cropping, furrow diking) and incentives for reducing late season irrigations | | | |
| 122 [138] | TBD | | | | |
| 123 [104, 140, 154, 174] | | | | | |
| 124 [143, 157, 175] | | | | | |
| 125 | | | | | |
| 126 [143] | | | | | |
| 127 | 4.8 TAF/Yr | Cost is $742/AF/Yr | | | |
| 128 | TBD | | | | |
| 129 [110, 146, 160] | | | | | |

| Table 11.5. Affected Flow Paths and Possible Actions, Sub-Region 11, Eastern San Joaquin Valley above Tuolumne River | | |
|---|---|---|
| **TB # (1) [duplicate]** | **Affected Flow Paths** | **Possible Actions** |
| 112 [131, 148, 171] | TBD | |
| 113 | Reduce farm surface and subsurface return flows: | Improve farm irrigation management (such as irrigation scheduling) and more uniform irrigation methods (such as shorter furrows, sprinkler, or drip |
| 114 [132] | TBD | |
| 115 [93, 134, 150, 172] | | |
| 116 | | |
| 117 [135] | | |
| 118 | TB Moved to Subregion 12 | |
| 119 | TB Moved to Subregion 12 | |
| 120 [82, 101, 137, 152, 173] | TBD | |
| 121 | Elimination of farm runoff from rain during January and February on fields that receive diazinon-based dormant sprays and drain to the Stanislaus River: | Cover crop, furrow or field diking, and reduction in late-season irrigation. Note: significant contributions to this Targeted Benefit could also be made through changes in chemical applications which are outside the scope of AgWUE. |
| 122 [138] | TBD | |
| 123 [104, 140, 154, 174] | | |
| 124 [143, 157, 175] | | |
| 125 | | |
| 126 [143] | | |
| 127 | Reduce ETAW on 19,340 acres of tree, vine and truck crops | Reduce ET flows using improved irrigation methods (primarily with drip), planned deficit irrigation, and greater planting densities. |
| 128 | TBD | |
| 129 [110, 146, 160] | | |

**Detail 113**

This section provides a detailed description of the methodology used to develop Quantifiable Objective 113. CALFED plans to complete the remaining Quantifiable Objectives by October 2000.

**Step 1. Quantified Targets**

Step 1 provides Quantified Target values by month and year type for the given Targeted Benefit. The Quantified Target provides a numerical value of "where we want to get to." Data are expressed as a water volume or a chemical concentration. For example, Targeted Benefit 113, Flow and Water Quality on the Stanislaus River, has two Quantified Targets:

A. Quantified Targeted (ERPP)
Flow regimes requested by the CALFED Ecosystem Restoration Program to restore salmon runs and,

B. Quantified Targeted Benefit (Water Quality)
Requested flow regimes from the US Bureau of Reclamation to meet water quality requirements at Vernalis.

The values from A and B were combined to give the Quantified Targeted Benefit for the flow/timing and water quality requirements on the Stanislaus River.

**Step 2. Reference Condition**

The Reference Condition quantifies the current condition of the constituent or flow that is targeted. TB #113, (Provide flow to improve aquatic ecosystem conditions in the Stanislaus River) focuses on altering river flows at specific times. The Reference Condition for this and other flow/timing Targeted Benefits is the flow in the targeted river reach for each month and year-type. For TB# 113, flow data did not exist for the targeted river reach, which is the reach of the Stanislaus River downstream of the two largest diversions and upstream of the confluence with the San Joaquin River. The flow for the targeted reach was computed as the difference between the stream flow upstream of the targeted reach (gauged at Goodwin Dam) and historical diversion data (for Oakdale and South San Joaquin Irrigation Districts) as follows:

*Reference Condition = Stanislaus River inflow to Sub-Region 11(gauged at Goodwin Dam) - Historical Diversions from Stanislaus River (primarily Oakdale and South San Joaquin Irrigation Districts)*

### Step 3. Quantified Targeted Benefit Change

The Quantified Targeted Benefit Change is numerical representation of then change required to move us to the Targeted Benefit or the difference between the Targeted Benefit and the Reference Condition as follows:

*Quantified Targeted Benefit Change = Targeted Benefit – Reference Condition*

### Step 4. Streamflow Data Conversion

The CVGSM breaks the Central Valley into 21 Sub-Regions. However, in some cases the area that affects a Targeted Benefit is only a portion of a Sub-Region. The subset of Sub-Region 11 that affects TB#113 is the Stanislaus River service area. Flow path data do not exist for this service area. The flow path values are approximated by proportioning the data from the Sub-Region by the following ratio for each month and year-type:

Diversion Ratio = Stanislaus River Diversions –Total Sub-Region 11 Stream Diversions

### Step 5. Flow Path Elements

A Flow Path is the course that water follows between entering and leaving a given water balance area. The Flow Paths considered in the Quantifiable Objective methodology are provided for each month and year type in Step 5.

Although all flow paths are listed, only the flow paths that can affect the given Targeted Benefit are used in computing its Quantifiable Objective. For Targeted Benefit areas that are subsets of a given Sub-Region, the flow path values are proportioned using the diversion ratios in Step 4. For TB #113 (flow in the Stanislaus River), the flow path elements are computed as follows.

*Flow Path Value for Stanislaus River service area = Diversion Ratio x Flow Path Value for Sub-Region 11*

### Step 6. Idealized Agricultural Potential (Farm and District)

This Step shows the maximum amount of water available if irrigated agriculture was perfect. This idealized potential, although impossible to achieve, is computed to provide the theoretical outer bound of contribution toward the Targeted Benefit. This bookend value is computed as the sum of all flow paths that can affect the Targeted Benefit. For TB#113 it is the sum of all district and farm surface and subsurface return flow values.

The Idealized Agricultural Potential is computed as two components: 1) District Potential and 2) Farm Potential. These components are computed separately because they represent distinctly different flow paths.

**Step 7. Available Agricultural Potential (Farm)**

The Quantifiable Objective, by definition, is the **local** and statewide cost-effective contribution toward the Targeted Benefit. This level of investment in Ag WUE would be equivalent to the statewide benefits generated.

However, it is virtually impossible to quantify the statewide benefits of a single Quantifiable Objective because an acceptable metric for the value of ecological resources is not readily available. CALFED intends to compute a range of Quantifiable Objectives for each Targeted Benefit and use a comparative analysis to select among the range of Quantifiable Objectives. This comparative analysis will consider the relative importance of the Targeted Benefits and the costs of their associated Quantifiable Objectives.

The range of Quantifiable Objectives is comprised of farm and district components of Available Agricultural Potential. The Available Agricultural Potential is the portion of the Idealized Potential that can be practically achieved. Step 7 computes the farm component of the Available Potential by considering the costs of changing the on-farm irrigation efficiency from its Existing level to High and Very High levels. The cost of moving to each of these target levels is computed as part of the analysis.

To move from the Existing efficiency to High or Very High requires a change in the management level and/or hardware of the farm irrigation systems. Possible changes in management level and hardware were based on logical progressions along the marginal on-farm cost curve for each major crop group in the given Sub-Region. For example, to achieve the High efficiency the new irrigation systems will likely have a greater amount of improved management of furrow irrigation system versus drip irrigation systems. However, to achieve the Very High level a much greater amount of drip irrigation systems would be installed. The cost estimates for the on-farm efficiency improvements were taken from data developed for the CVPIA-PEIS, 1994. The improved efficiency levels vary by Sub-Region. Sub-Region 11 the High level occurs at 77% and Very High occurs at 82% (computed as the percent of diverted water that is evapotranspired).

The definitions of High and Very High efficiency will be selected for each Sub-Region based on judgment and experience. For Sub-Region 11, Very High efficiency was selected as the point along the Sub-Regional marginal cost curve at which cost begin to escalate significantly. The High efficiency level was selected as the point approximately mid-way between Existing and Very High Efficiency.

The farm component of Available Agricultural Potential is the change in the targeted flow paths that would occur in moving from existing to High and Very High efficiency. For example, the targeted flow paths for TB# 113 (flows in the Stanislaus River) are all district and farm return flow paths. Therefore the farm component of the Available Agricultural Potential is the reduction in farm surface and subsurface return flow that would result from changing efficiency from 62% (existing) to 75% (High) and 87% (Very High).

**Step 8. Available Agricultural Potential (District)**

The district or water supplier component of Available Agricultural Potential is computed similarly but with a few notable differences. First, the district component is subdivided into surface and subsurface subcomponents because distinctly different practices are employed to reduce these two flow paths. Subsurface district return flow is primarily made of canal seepage which is addressed through canal lining, piping, or seepage recovery methods. District surface losses are primarily composed of operational spillage which is typically addressed through increased operational labor, canal automation, canal interceptors and canal automation.

Unlike the farm efficiency, limited data exist describing the marginal cost of altering these two flow paths. Using data from the Imperial Irrigation District canal lining project, it was estimated that subsurface return flows would be 8 % of district diversions at High Efficiency and 4 % of diversions at Very High Efficiency. An even more limited data set based on the history of Imperial Irrigation District spill reduction efforts was used to estimate that surface return flows would be 10 % of district diversions at High Efficiency and 4 % of diversions at Very High Efficiency. The cost of achieving these levels was also estimated.

**Step 9. Quantifiable Objective**

To compute the Quantifiable Objective, the farm and district components of the Available Agricultural Potential are combined and compared to the Targeted Benefit. The High and Very High potentials are combined into four Quantifiable Objective levels as follows:

| Quantifiable Objective Level | Farm Efficiency | District Efficiency |
|---|---|---|
| 1 | Existing | High |
| 2 | High | High |
| 3 | High | Very High |
| 4 | Very High | Very High |

These four levels were defined using judgment and experience and reflect the expected transition from existing to higher efficiency levels.

If the Targeted Benefit is less than the combined Available Agricultural Potential, then the Quantifiable Objective can fully achieve the Targeted Benefit and is set equal to that value. If the Available Agricultural Potential is less than the Targeted Benefit, the Quantifiable Objective is equal to the Available Agricultural Potential.

**Details 121 and 127**

The data and computations representing Quantifiable Objectives #121 and 127 are also provided. A detailed description of these computations will be included as part of a comprehensive methodology to be produced in late July 2000.